Woodstove Changeout Workshop

Nature and Magnitude of the Problem

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U.S. EPA Office of Air Quality Planning and Standards

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Purpose of Presentation

Provide overview of:

- **Why we care - health and safety**
- **PM 2.5 emission inventory information**
- **PM 2.5 source apportionment information**
- **HAPs information**

What's in Wood Smoke?

"Ah, the sweet smell of wood smoke" - but what makes it so "sweet"?

- CO, NO_x, SO_x, and PM
- Toxics, including:
  - Benzene
  - Toluene
  - Aldehyde gases
  - Polycyclic organic matter
  - Dioxin

Why Do We Care About Residential Woodsmoke?

- Fine particle pollution (PM2.5)
  ~6 % (430,000 tons) of total PM2.5 direct emissions
  ~80% of that from woodstoves

- More than all of the US petroleum refineries, cement manufacturing and pulp and paper plants combined

- Changing out 1 old, dirty inefficient woodstove equivalent to taking 7 diesel buses off the road.

Particulate Matter: What is It?

A complex mixture of extremely small particles and liquid droplets

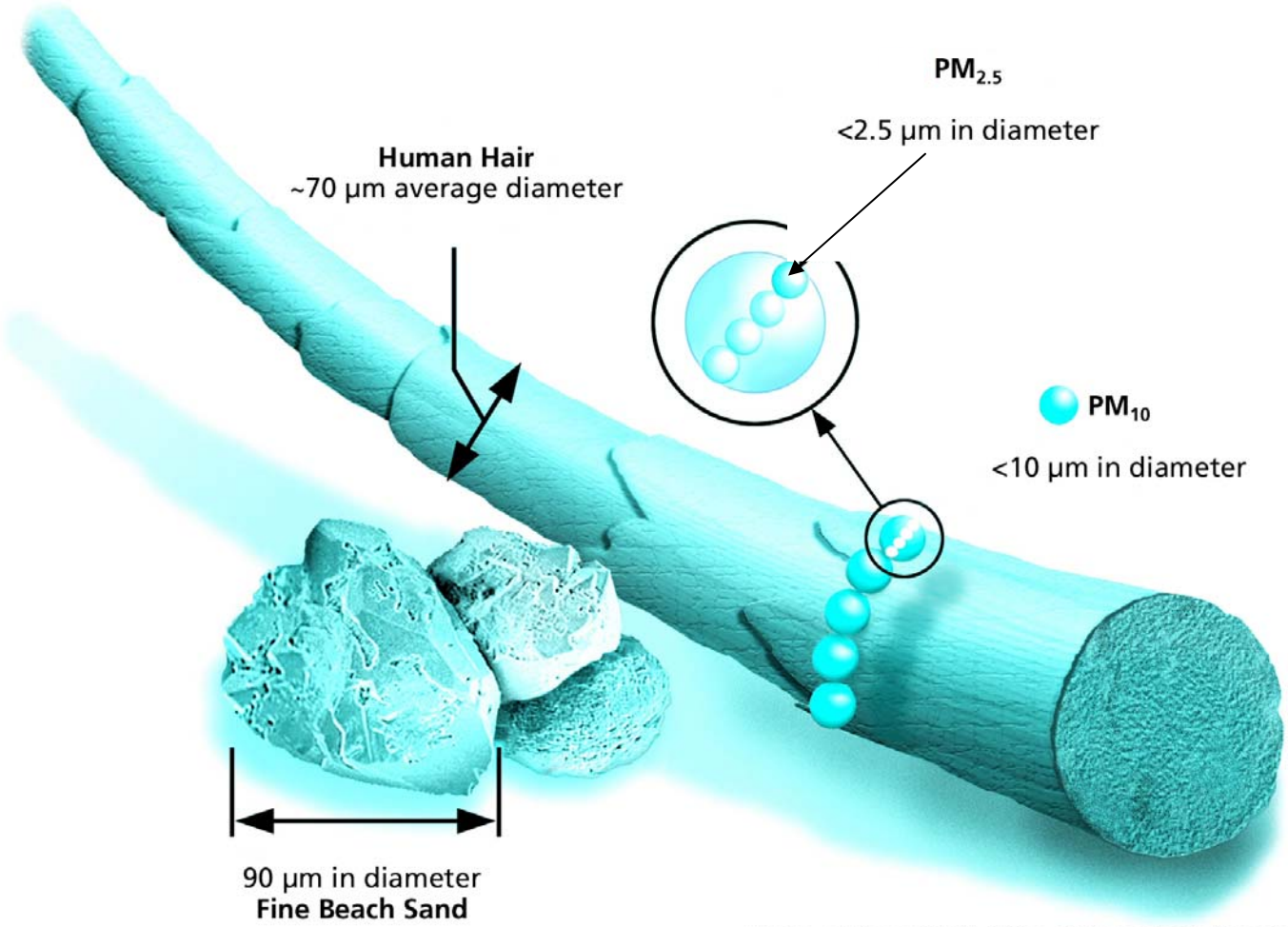
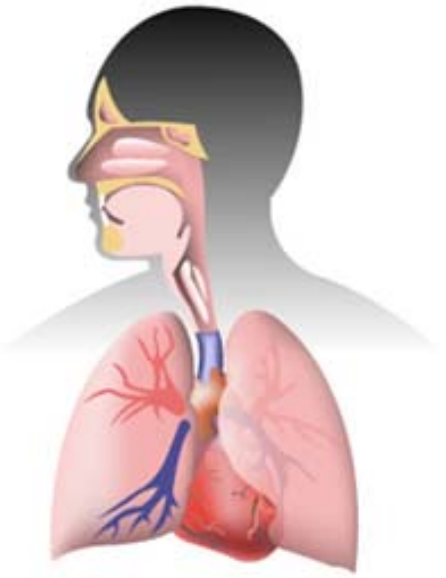


Image courtesy of EPA, Office of Research and Development

Particulate Matter

- Larger particles (> PM_{10}) deposit in the upper respiratory tract



- Smaller, inhalable particles (≤ PM_{10}) penetrate deep into the lungs

Model of interior human lung

- Both coarse $PM_{10-2.5}$ and fine $PM_{2.5}$ can penetrate to lower lung
- Deposited particles may accumulate, react, be cleared or absorbed

Heath Effects of Particle Pollution

Many scientific studies have linked breathing particle pollution to a series of significant health problems:

- Aggravated asthma
- Increases in respiratory symptoms like coughing and difficult or painful breathing
- Chronic bronchitis
- Decreased lung function
- Premature death

Benefits from Reducing Fine Particulates

In 1997, EPA estimated that meeting the <u>current</u> fine particle standards will prevent at least:

- 15,000 premature deaths;
- 75,000 cases of chronic bronchitis;
- 10,000 hospital admissions for respiratory and cardiovascular diseases;
- 20,000 cases of acute bronchitis;
- hundreds of thousands of occurrences of aggravated asthma; and
- 3.1 million days when people miss work because they are suffering from particle-related symptoms.

Why Are We Acting NOW?

EPA finalized $PM_{2.5}$ "designation" areas in 2004

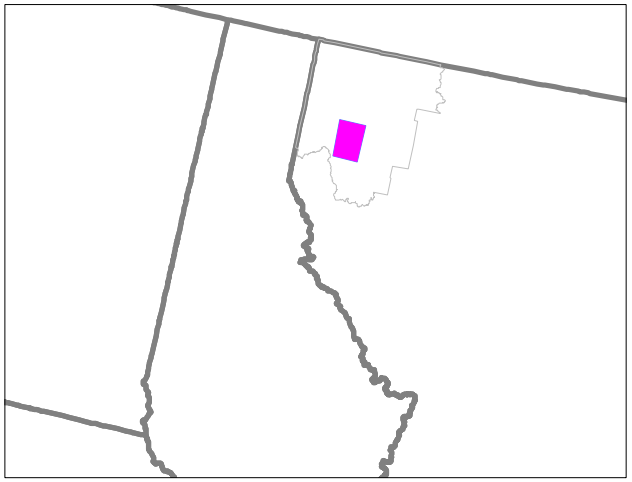
- Areas where air quality does not meet the $PM_{2.5}$ standards are considered "nonattainment"
- By law, nonattainment areas must develop plans and institute measures to reduce emissions in order to come into "attainment"
- State plans are due by 2008
- States are expected to meet standard ASAP, and not later than 2010

But that's not all . . .

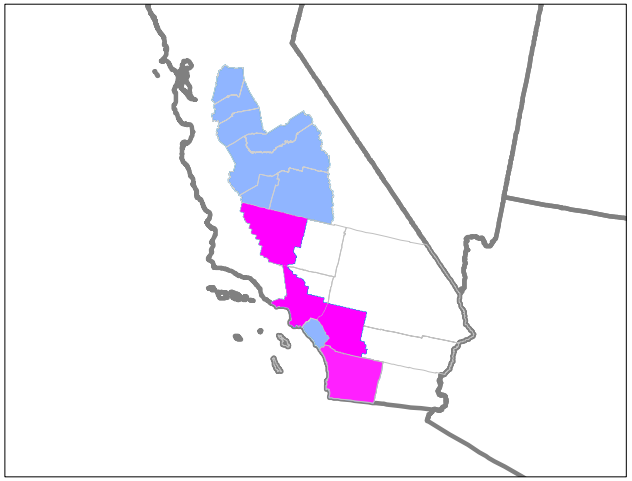
EPA recently proposed revisions to the $PM_{2.5}$ standard (December 20, 2005)

- Proposed revisions include lowering 24-hour fine particle standard from current level of 65 µg/m3 to 35 µg/m3
- Not final, but if adopted, many more areas are expected to be classified as nonattainment
- If finalized, State plans would be due by 2013
- States would be expected to meet standard ASAP, and not later than 2015

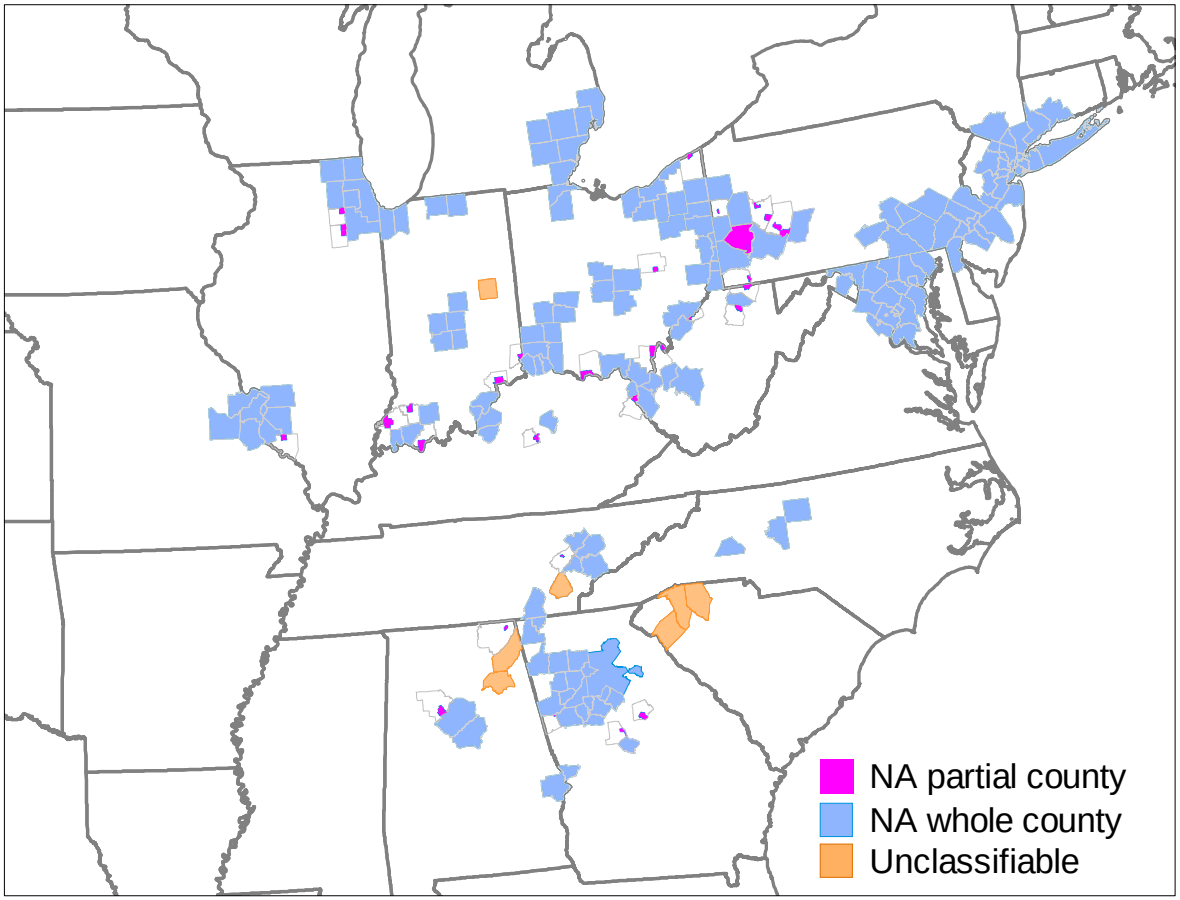
Current PM2.5 Nonattainment Areas



Montana



California



Eastern U.S.

A Large Quantity of Emissions; Many Woodstoves; Many Areas

- **Again, it is 430,000 tons, ~6% of the total PM2.5 direct emissions!**
- 40-45 million wood burning appliances in U.S
- 15 million of those are wood stoves, either free standing or fireplace inserts
- 75% of those in use are old, pre-NSPS

Old “Conventional” Woodstoves (built before 1990)

Slide from Wood Heat Organization Inc

Advanced Woodstoves (EPA-Certified – built after 1990)

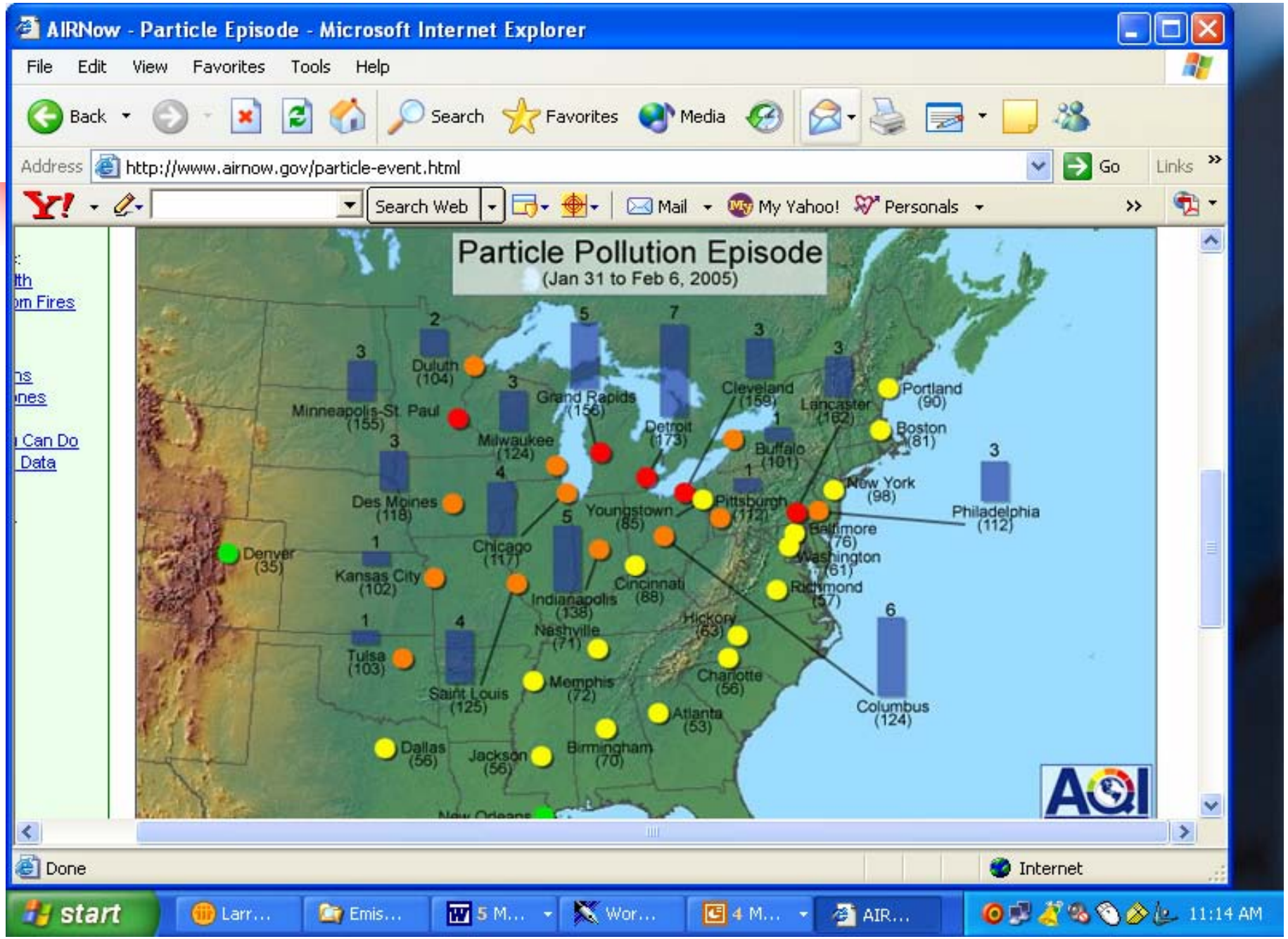
Slide from Wood Heat Organization Inc

How Many Old Woodstoves Are In A Specific Area?

- Not easy to say
- U.S. Census Data – American Housing Survey
- Market Research Firms
- State, local, tribal and other surveys

Potential for Local Exposures/Non-Attainment

- Occurs where people live
- Short “stacks”; poor dispersion
- Exposure may be higher per ton than from industrial sources
- Short term PM2.5 peak exposures are a concern in some areas
- Over 40 communities have burn bans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Duluth (104)
Minneapolis-St. Paul (155)
Grand Rapids (156)
Milwaukee (124)
Detroit (173)
Cleveland (159)
Buffalo (101)
Lancaster (162)
Portland (90)
Boston (81)
New York (98)
Philadelphia (112)
Pittsburgh (112)
Baltimore (76)
Washington (61)
Richmond (57)
Des Moines (118)
Chicago (117)
Youngstown (85)
Cincinnati (88)
Indianapolis (138)
Denver (35)
Kansas City (102)
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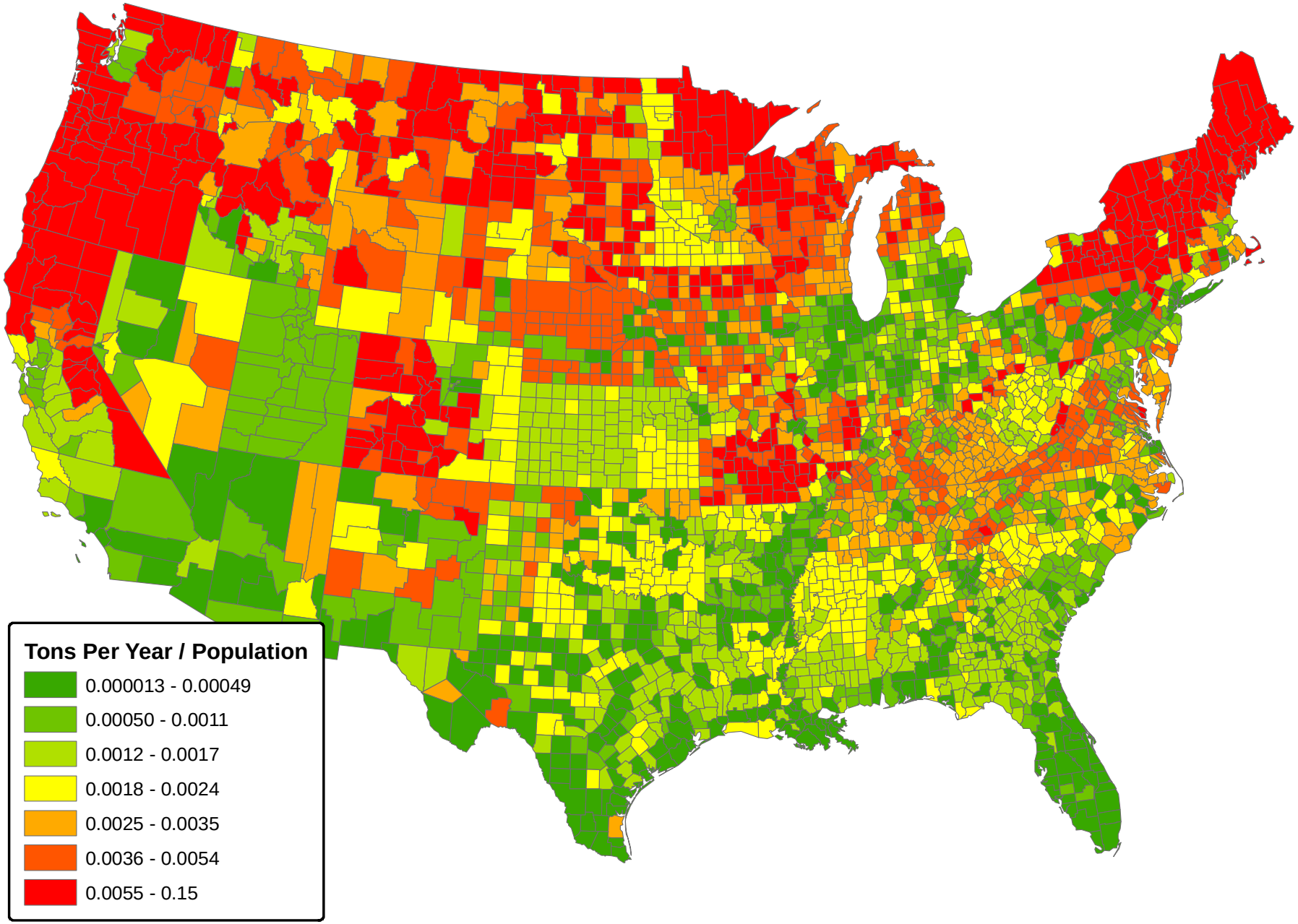
PM Source Apportionment Monitoring Data

- In East, “biomass” burning is 0.3 - about 2 ug/m3
- Biomass includes wildfires and prescribed fires in addition to residential. Amount that is residential wood is uncertain
- More research is needed

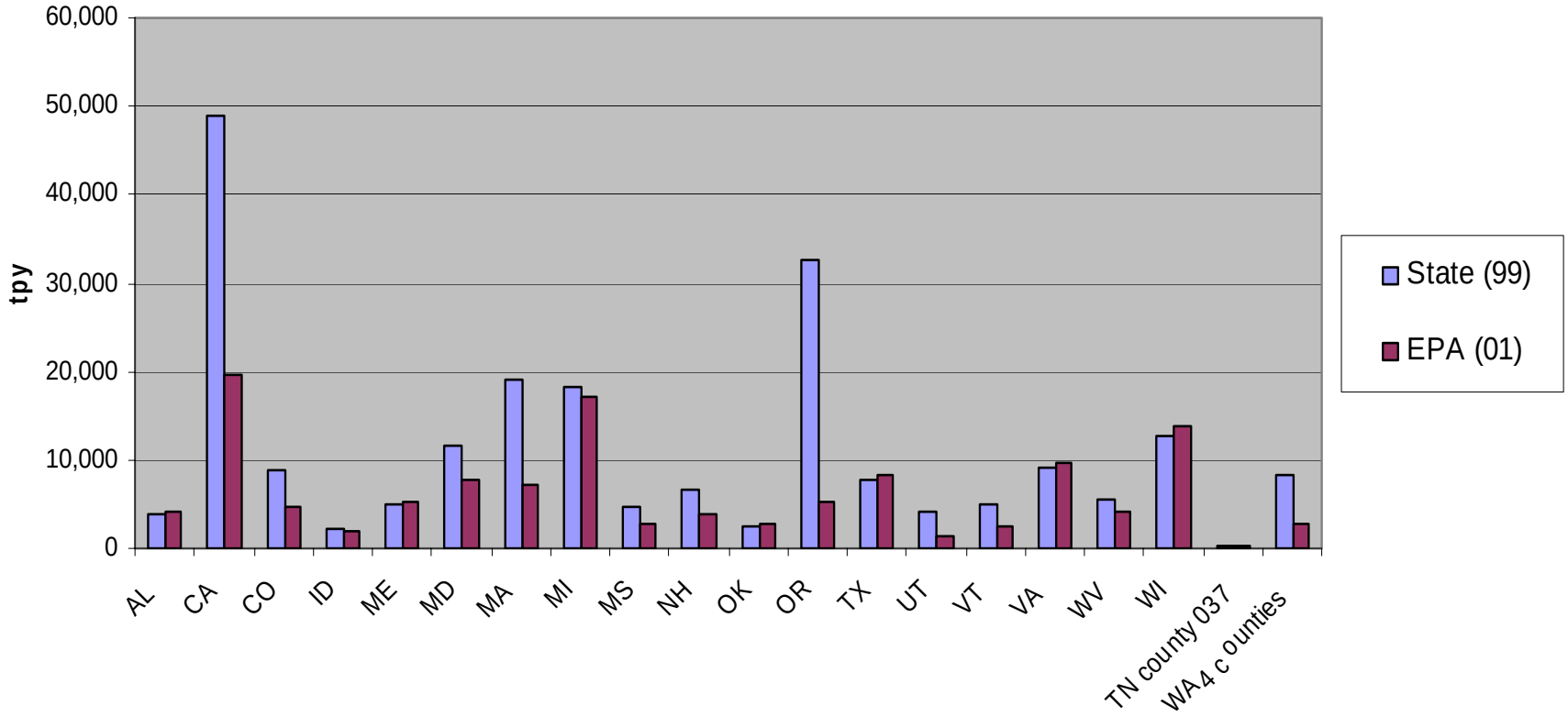
Reliability of Emissions Inventories and Projections

- The National Emission Inventory (NEI) is a mix of federally estimated data and state data
- The federal NEI estimates for RWC are derived from an estimate of wood consumed in the residential sector at the national level from the Department of Energy's Energy Information Administration (DOE/EIA)
- Estimates are more reliable at higher levels of aggregation than at the county level or lower

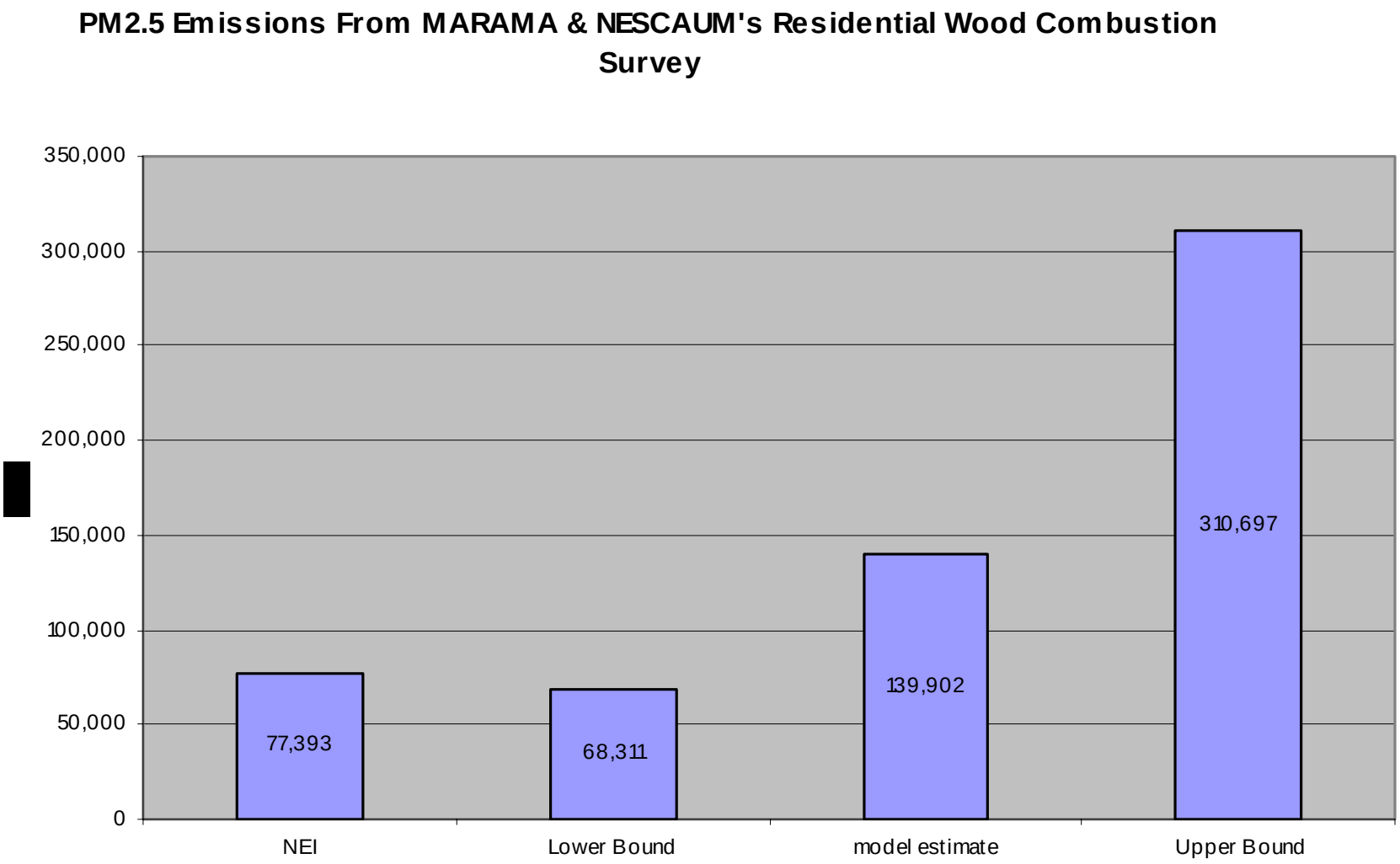
2002 PM2.5 Primary Emissions from Residential Wood Combustion



EPA and State PM2.5 Emission Inventory Estimates for Residential Wood Smoke



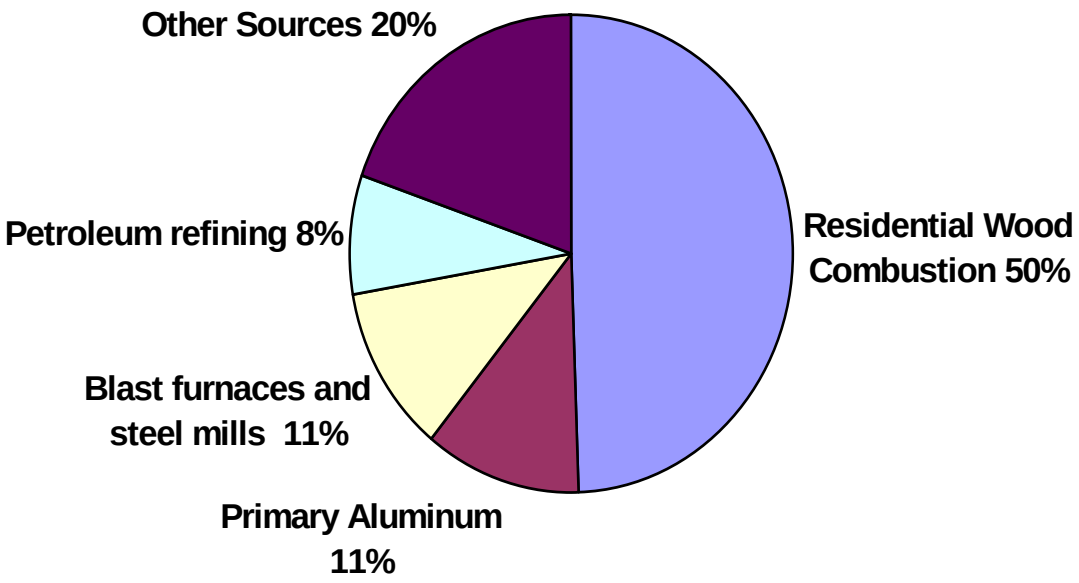
2004 MARAMA and NESCAUM Residential Wood Smoke Emission Estimates



Residential Wood Smoke
Why else do we care?

- **Toxics – Polycyclic Aromatic Hydrocarbons**
  - Contributes ~ 22% of all 7 carcinogenic PAHs, e.g., benzo(a)pyrene
- **Indoor Air**
  - Old wood stoves are often poorly sealed
  - Improper ventilation of woodstoves and fireplaces
  - Also, what's outside often comes inside via HVAC
- **Fire Safety**
  - Creosote build-up in chimney from old stoves is faster

% of Total Benzo(a) Pyrene (BaP) Emissions in Great Lakes Area = 51,000 lbs. 1999 Data



* 1999 Great Lakes Toxics Inventory

Conclusion

- Residential wood smoke emissions are a significant source of PM and toxics in numerous areas
- A cost-effective opportunity for –

  "Real air emission reductions for real people"

- Questions/comments?

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